The status of training and education in information and computer technology of Australia's nurses: a national survey

Concise title: Training and education of Australian nurses in ICT

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***Acknowledgements**:* The survey was conducted by the Centre for Rural and Remote Area Health for the Australian Nursing Federation with funding from the Australian Government Department of Health and Ageing.

ABSTRACT

Aims and objectives: A study was undertaken of the current knowledge and future training requirements of nurses in information and computer technology (ICT) to inform policy to meet national goals for health.

Background: The role of the modern clinical nurse is intertwined with ICT and adoption of such technology forms an important component of national strategies in health. The majority of nurses are expected to use ICT during their work however the full extent of their knowledge and experience are unclear.

Design: Self-administered postal survey.

Methods: A 78 item questionnaire was distributed to 10,000 Australian Nursing Federation members to identify the nurses' use of ICT. Eighteen items related to nurses' training and education in ICT.

Results: Response rate was 44%. Computers were used by 86.3% of respondents as part of their work related activities. Between 4-17% of nurses had received training in each of 11 generic computer skills and software applications during their pre-registration/enrolment and between 12-30% as continuous professional education. Nurses who had received training believed that it was adequate to meet the needs of their job and was given at an appropriate time. Almost half of the respondents indicated that they required more training to better meet the ICT requirements of their jobs and a quarter believed that their level of computer literacy was restricting their career development. Nurses considered that the vast majority of employers did not encourage ICT training and for those for whom training was available workload was the major barrier to uptake. Nurses favoured introduction of a national competency standard in ICT.

Conclusions: For the considerable benefits of ICT to be incorporated fully into the health system employers must pay more attention to the training and education of nurses who are the largest users of that technology.

Relevance to clinical practice: Knowledge of the training and education needs of clinical nurses with respect to ICT will provide a platform for the development of appropriate policies by government and by employers.

INTRODUCTION

Healthcare is an information intensive industry in which quality and timely information is a critical resource. Computer driven technologies are providing the means to acquire that information. Potential benefits of information and computer technology (ICT) use in the health care industry include those anticipated within any other industry or business such as improved efficiency and communication. Adoption of appropriate technologies to support health delivery in Australia is driven in part by the national strategies for electronic health records (National Health Information Advisory Council 2001).

However the over-arching goal of the adoption of ICT within healthcare is to improve patient care in a cost effective manner. To that end both old and new and technologies are being adapted. For example bar codes, invented in 1952 and used in retail since 1974 (Bellis 2007), have been introduced during dispensing of medicines (Bendigo Health 2006). Use of this half century old technology has been shown to be effective (Anderson & Wittwer 2004) and will go a long way to reducing medication errors which were estimated in 1999 to account for 40% of the avoidable 80,000 medication-related hospitalisations in Australia each year at a cost of at least $350 million per year (Roughead 1999).

Other technologies and applications are much newer and have tremendous potential. The Internet has been the vehicle for the delivery of information such as the knowledge based information systems that have been rolled out to support evidence based practice (e.g. http://ckn.health.qld.gov.au/). Telehealth is blossoming thanks to the use of mobile devices

such as PDA's that provide quick access to information, are flexible and offer convenient point of entry for patient data (Davenport 2004, Jackson & Dewar 2004).

Nurses, as the largest sector of the workforce, are the greatest users of ICT in the health industry. To use the available technology to its potential, provision of access alone is not sufficient; skill or ability must be adequate. As has been concluded by many researchers, skills must be built into undergraduate nursing curriculum so that graduates possess the necessary basic computer skills and specific knowledge of available resources (Griffiths & Riddington 2001, McCannon & O'Neal 2003). Furthermore once employed, employers of nurses need to provide accessible and relevant education and training to maintain and build upon these skills and knowledge (Curran 2003, Staggers *et al*. 2002).

Several reports exist suggesting that Australian nurses have a deficit of skills in ICT and this compromises the use of the technology and the benefits that are offered (Edirippulige 2005, Webster *et al*. 2003). The study reported herein was undertaken in 2005 by an independent research group commissioned by the Australian Nursing Federation with funding from the Australian Government's Department of Health and Ageing. It is the first to capture a national picture of ICT in the nursing profession in Australia. Access to computers, knowledge and use of ICT, barriers to ICT use, training and education and ICT support were all determined. The results are intended to support the development of national strategies to meet the needs of nurses. This paper reports on past training and education and future training requirements.

METHODS

Project steering group

A project steering group of 11 members was established. Members represented nurses, private hospitals, chief nursing officers, deans of nursing and midwifery, Federal Government and the discipline of nursing informatics.

Questionnaire development

A questionnaire (available from http://www.anf.org.au/it_project/) was developed consisting of 78 questions in sections covering personal background; access to computers and the internet; uses of information technology in the work place; job requirements for IT; barriers to use of computers; technical support, management attitudes and training and education in information technology. An open-ended question (Q78) allowed for comments from respondents on any aspect of the survey.

Questions 47 – 64, the focus of this paper, were on Training and Education in Information Technology where the latter was defined as computer-based systems that assist in the management and processing of information to support healthcare and healthcare delivery. The word 'training' as used in the questions was defined to participants as a generic term to encompass all activities ranging from single training events to longer term education towards certificates and degrees.

Question design was informed by the extant literature and undertaken after extensive consultation with 55 representatives from Australian State and Territory governments, other health and aged care organisations and the National Nursing Organisations. The consultations took place by telephone interviews (n=25) and a focus group with 30 participants. To ensure content validity, comprehension and clarity of the novel questions several iterations of the survey followed repeated review by the project steering group. In addition two separate pilot studies were undertaken with nurses. The first study involved nurses employed by a tertiary teaching institution. Following that pilot small changes were

made to the wording of some questions to improve clarity and comprehension. A second pilot was then undertaken by a group of clinical nurses from Queensland who were attending a course in Brisbane. No further changes were deemed necessary after this pilot.

Participants

In July 2005 the questionnaire was posted to 10,000 members of the Australian Nursing Federation (ANF) by the ANF State and Territory branch offices. Stratification of the sample was by Australian Standard Geographical Classification (Australian Bureau of Statistics, 2006) with metropolitan, inner regional, outer regional and rural/remote areas each receiving 25% of the surveys. Members polled included Assistants in Nursing, Enrolled Nurses and Registered Nurses levels 1 - 5. Questionnaires were returned to the researchers in reply-paid envelopes. A second mail-out was sent by the ANF to all non-respondents three weeks after the first mail-out. The only information made available to the research team was the post codes of the respondents so that responses by strata could be determined.

Analysis

Quantitative data were entered using TeleForm (Verity Inc. Sunnyvale, California) and analysis was undertaken using SPSS v12 (SPSS Inc, Chicago, Illinois). Categorical variables were analysed using the chi-square test. Main effects are reported as significant if both p <0.05 and the Phi coefficient or Cramer's V was 0.10 or greater. Comparisons between categorical variables and continuous variables were determined by analysis of variance. An F statistic was considered significant if $p < 0.05$. For comparison of two continuous variables, a Pearson correlation coefficient was used and consistent with other analyses, a relationship was considered meaningful if $p < 0.05$ and Pearson's $r \geq 0.10$. Each question was analysed on the basis of all responses and also by age, length of time in nursing, geographical region, level of job and health sector.

Consent

The study was approved by the University of Southern Queensland's Human Research and Ethics Committee. A plain language statement was enclosed with the questionnaire. Informed consent was implied if the participant returned a completed questionnaire.

RESULTS

This paper focuses solely on the education and training section of the survey with results presented as overall responses to the questions and after further analysis by age, length of time in nursing and level of job. Results on attitudes to IT, uptake of IT by nurses, barriers to computer use and difference in use of IT in nurses and by geographical location and sector of employment are not discussed and will be the subject of future papers.

The overall response rate to the 10,000 distributed questionnaires was 43.3%. The mean age of respondents was 45.3 (SD 9.7) years, 92.8% of respondents were women and 86.3% used a computer for work-related activities.

Training received

Nurses were first asked to identify in which of 11 applications (the term 'application' is used for both computer skills and computer software programmes) they had received formal training during pre-registration or pre-enrolment education (PRPE) and during their employment as continued professional education (CPE).

Results are summarised in Table 1. Fewer than 17% of respondents had received formal training in any application PRPE and 28.2% for training in word processing was the highest received as CPE. For all applications the proportion of nurses who had training as CPE exceeded those during PRPE. The number of nurses who reported that they had received

training for the same application at both PRPE and as CPE was between 1.3 - 3.5% (between 50 - 154 nurses across the 11 applications).

Table 1. Training in ICT received by nurses pre-registration/pre-enrolment (PRPE) or as continuous professional education (CPE).

Application	When training occurred			
	PRPE		CPE	
	n	%[1]	n	%
Keyboard skills	662	15.3	1019	23.5
File management	262	6.1	584	13.5
Word processing	577	13.3	1223	28.2
Spreadsheets	331	7.6	829	19.1
Databases	360	8.3	729	16.8
Email	523	12.1	1202	27.8
Library searches	732	16.9	890	20.6
Internet	523	12.1	982	22.7
Patient management	355	8.2	1052	24.3
Administration systems	190	4.4	655	15.1
Information management	174	4.0	545	12.6

[1]percentage of total respondents

Nurses who had received PRPE training were younger than those who had no training at PRPE other than for the applications of patient management, administration systems and information management. For example, the mean age of nurses with training in word processing at PRPE was 41.5 (SD 0.40) years as compared to 45.8 (SD 0.16) years for those who had received no PRPE training. In contrast nurses who benefited from CPE in word processing were older (48.1 SD 0.28 years) than those who had no CPE (44.1 SD 0.17 years).

The length of time that respondents had been employed in nursing was a significant factor in the timing of training for the majority of applications. Nurses with the shortest time in nursing had received more PRPE training than had long serving nurses. For CPE the opposite occurred, with an increase in the percentage of nurses receiving training for each additional five year time period they had been employed as a nurse. This is demonstrated in Table 2 for

the application of email where 31.4% of nurses in the 0-5 years of nursing band had received training PRPE while the similar percentage (31.9%) who received training CPE had been in nursing for 16-20 years0.

The exceptions were for the three software applications of patient management, administrative systems and information management for which there was no significant PRPE training effect by length of time in nursing. However in contrast for CPE there was a significant effect with the percentage of nurses receiving training rising from 5.9% for nurses with up to 5 years of employment to 19.3% for those nursing in excess of 30 years.

Table 2. Pre-registration/enrolment (PRPE) and continuous professional education (CPE) training in ICT for email as a function of length of time in nursing.

		Years since first worked as nurse						
		0-5	6-10	11-15	16-20	21-25	26-30	31+
PRPE	Number	127	66	35	55	58	58	56
	% in year band	31.4[1]	17.1[1]	8.3	8.8	9.0	10.2	11.2
CPE	Number	53	91	105	200	231	220	207
	% in year band	13.1[2]	23.6[3]	24.9[3]	31.9	36.0	38.8	41.6

[1]significantly ($p < .05$) more than all periods greater than 10 years
[2]significantly ($p < .05$) lower than all periods greater than 5 years
[3]significantly ($p < .05$) lower than all periods greater than 15 years

Level of job also had a major effect for CPE with significant effects for every application. The proportion of nurses undergoing training increased from Assistants in Nursing (AIN) to the level of Registered Nurse (RN) 3 (Table 3). No significant changes were noted among RNs at levels 3, 4 and 5.

Table 3. Proportion of respondents receiving continuous professional education in ICT by level of job

Application	Level of Nurse[1]						
	Assistant in Nursing	Enrolled Nurse	Registered Nurse				
	AIN	EN	RN1	RN2	RN3	RN4	RN5

Keyboard	8.0[2]	19.0	21.2	26.9	28.9	28.9	30.8
File management	6.8	10.3	11.2	14.0	19.1	24.6	17.4
Word processing	7.4	19.6	23.3	34.3	39.6	39.8	39.2
Spreadsheets	6.2	10.3	13.6	23.6	32.3	32.0	29.4
Databases	5.6	9.8	13.2	19.2	28.6	27.0	22.7
Email	5.6	17.1	23.8	36.6	41.1	39.8	29.7
Library Searches	5.6	11.8	17.2	28.2	30.6	27.3	25.5
Internet	6.2	15.9	20.6	26.5	32.0	29.7	27.7
Patient management	5.6	13.1	25.7	27.8	31.8	39.8	25.2
Administration systems	4.3	6.4	11.4	17.3	22.7	30.1	27.2
Information management	5.6	4.8	10.3	13.2	19.3	25.8	21.0

[1]for all applications significant ($p < .05$) effects between level of job and the next level of job up to RN3
[2]percentage of respondents within job level

Training details

For each application there were a series of questions related to the most recent training event attended by the respondent. Questions asked who were the trainers, what was the format of the training, where training was held relative to the workplace and the timing of the training relative to the survey date.

Group training was the principal format for training, undertaken on average across all applications by 52.4% of nurses who had received training. This was followed by one-on-one training (23.3%), self-taught (21.1%) and distance learning (3.0%). The most recent training was either undertaken at work during work hours (41.3%) or away from work in their own time (42.2%). Much smaller proportions of training occurred at work in their own time (6.3%) or away from work in work time (10.1%).

The proportion of nurses being trained by a colleague, an in-house trainer based outside the place of work, an in-house trainer based inside the workplace and a commercial trainer were 15.7%, 18.9%, 23.1% and 42.1%, respectively. The percentages of the total nurses in the study who had undertaken their most recent ICT training less than 6 months prior to completion of the questionnaire, between 6 months to 1 year, 1-3 years and greater than 3 years were 3.2%, 3.1%, 6.1% and 9.4%, respectively.

When training had been received, the percentage of nurses who believed that it was adequate to meet their current work demands varied between a low of 58% for administration systems to a high of 80.3% for keyboard skills. On average across all applications 68% of the nurses who had formal training PRPE or as CPE believed that the training they had received in that application met the needs of their current job. Furthermore, 70% of respondents stated that the training they received was given at an appropriate time.

Requirement for training

All nurses regardless of whether they had ever received any ICT training were asked whether they believed they required further training to better meet the requirements of their current job. Results are presented in Table 4. For each application between 30.7-51% (mean of 44% across all applications) of respondents believed they needed further training. The common applications such as use of the keyboard, email and internet were least likely to be seen as skills required, whilst spreadsheets, databases and patient management systems were noted by the greatest number of respondents as areas in which they required training.

Comparisons of the requirement for further training between those nurses who had or had not ever received training are also presented in Table 4. Even if training had been received previously between 30.8% (keyboard) and 45.2% (information management) of nurses believed that they required further training. For all applications except for keyboard skills more nurses believed they needed training if no previous training had been received. The greatest differential was for library searches with a 50% increase in nurses who believed more training was required from 36.5% if previous training had been received to 54.4% if no training had been received.

Table 4. ICT skills nurses believe are required to meet their current job requirements

Application	Further training required (%)		
	Overall response	If received prior training	If received no prior training
Keyboard	30.7	30.8	30.7
File management	45.7	37.4[1]	47.6
Word processing	37.8	33.3[1]	40.6
Spreadsheets	49.0	42.1[1]	51.4
Databases	51.5	43.3[1]	54.1
Email	33.1	30.6[1]	34.7
Library searches	48.3	36.5[1]	54.4
Internet	36.0	31.6[1]	38.2
Patient management	52.7	44.0[1]	56.3
Administration systems	45.3	44.5[1]	45.5
Information management	51.0	45.2[1]	52.1

[1]significantly ($p < .05$) lower percentage of responses from nurses who had received prior training than if they had received no prior training.

The requirement for additional training differed across the levels of nurse. There was a consistent trend across all applications for more RN3 and RN4 to believe further training was required than by the other levels of nurses. However this difference was only significantly higher for training in the applications of spreadsheets and databases (Table 5). In response to a question on their most preferred training method, one-on-one training (35.8%) was the highest, preferred by nearly twice as many respondents as those who would prefer workshops (19.8%). Preferences for distance learning (3.6%) and self teaching (4.1%) were small.

Table 5. Training requirements in ICT by level of job

	AIN	EN	RN1	RN2	RN3	RN4	RN5
Spreadsheets	36.4[1a]	48.0[b]	43.0[c]	52.9[a]	62.6[abc]	60.9[abc]	53.5[a]
Databases	38.3[a]	49.7[b]	47.9[c]	53.9[a]	60.4[abc]	63.7[abc]	57.4[a]

[1] percentage of respondents within job level
[abc]same subscripts in row differ ($p < .05$)

Impact on career

Over a quarter of all respondents either strongly agreed (5.9%) or agreed (19.4%) to the statement that their current level of computer literacy was restricting their career

development. Those who disagreed or strongly disagreed were 27.7-12.8%, respectively with 31.3% stating that they neither agreed nor disagreed. Younger nurses and, as shown in Table 6, those who had been nursing for fewer years, were significantly less likely to agree that computer literacy was a restriction to their career. When asked if they would train towards a national competency (e.g. Computer Driving Licence) if it was offered by their employer, only 5.1% of respondents said 'no', 73.1% said 'yes' and 21.8% did not know. Respondents who said 'no' were significantly older by over 3.3 years.

Table 6. Effect of time in nursing on the belief by nurses that computer literacy was restricting their career development

Length of time in nursing (years)	Mean[1]
0-5	3.405[abcde]
6-10	3.271
11-15	3.179[a]
16-20	3.188[b]
21-25	3.220[c]
26-30	3.170[d]
31+	3.196[e]

[1]from five point Likert scale of strongly agree =1, agree =2, neither agree or disagree = 3, disagree = 4 and 5 = strongly disagree
[abcde]same superscripts in column differ ($p < .05$)

Barriers to training

The responses from nurses who use a computer at work to a question as to the extent of each of six potential barriers to accessing ICT training in the workplace is presented in Table 7. Workload issues such as time and lack of relief staff were identified by the majority of respondents as being the major barriers to training. The smallest barrier was interest. Time was considered a major barrier by all levels of nurse; however for all other factors the AIN, EN and RN1 consider the factor to be a more frequent barrier than did RN2-5. Lack of support and lack of relief staff were more likely to be identified as a barrier by older nurses.

Table 7. Barriers to accessing ICT training in the workplace

Factor	Extent of the factor being a barrier		
	Very often or always	Sometimes	Never or rarely
Time	56.4[1]	27.3	16.4
Money	35.2	23.0	41.8
Lack of support	38.1	27.1	34.9
Lack of relief	61.2	20.5	18.4
Computer access	26.8	22.8	50.4
Lack of interest	13.3	29.4	57.3
Other barriers	3.1	.6	1.6

[1] percentage of respondents

In response to a question on employer attitude to ICT training, 1.7% of respondents reported that training was discouraged in their workplace, 37.8% noted it was encouraged and 5.9% that training was mandatory. However over half (54.6%) said that training was not referred to at all.

Comments on education and training

A total of 475 nurses made comments in the open ended question (Q78) about education and training and competencies in ICT. It was accepted that training would increase the use of ICT by nurses. One respondent's comment best summarises the views of the majority of nurses who commented:

> *We need more training!!!*

Formal training was recognised as being important, with informal training from colleagues having potential undesirable effects:

> *Training for new staff is not formalised but relies on current staff providing 'on the job' training often in busy situations. This leads to incorrect data entry and subsequently revenue losses and delays.*

Respondents provided guidance on how they saw future training should be given:

Improved or greater availability of study leave to be made available to workers would encourage and allow people to explore options for continuing education in IT/health informatics etc.

We need greater flexibility in working hours to permit [both] study and work commitments.

Whilst some nurses noted that ICT was a constant part of their undergraduate programme others noted that their undergraduate program offered no ICT training:

I used IT constantly for my pre-registration course - email, websites, discussion

My bachelor of nursing degree offered no computer training so I decided to attend the IT module of the university preparation program.

Seventy-nine participants outlined what they considered were barriers to education and training. Many nurses noted that while education and training was available in work-time, staffing issues prevented them attending:

I have been scheduled twice to attend during work time but due to lack of senior staff/sick leave etc have been re-allocated to the ward area.

Others noted that financial considerations prevented them attending information technology training and saw this as a lack of commitment by the management:

Budget, budget, budget!!! - Never enough money to train nurses who are desperately eager and keen to increase IT knowledge.

DISCUSSION

Information and computer technology has become an integral part of all aspects of modern society and health is no exception. It should be a logical step to assume that for ICT to be of greatest benefit to the health professionals and ultimately their clients, the users should be knowledgeable and comfortable in the field.

Nurses may not need a high degree of computer expertise; however their performance will be much more efficient if they have good computer skills (Jiang *et al*. 2004). Furthermore nurses who possess a good sense of technology are more likely to be prepared to interact with applications such as with clinical information systems and clinical decision support systems (Maag 2006).

Computer literacy has been defined as 'the skill of using computer applications to accomplish work within your discipline' (Smedley 2005). Computer literacy in nursing, as with any other discipline, comes from a combination of education, training and experience. This study determined past exposure and future needs for education and training in nursing in Australia as it relates to computer literacy. A somewhat similar national study was undertaken in the UK (Bertulis & Lord 2005) and two small studies in Australia have collected evidence from individual hospitals (Edirippulige 2005, Webster *et al*. 2003). However, to our knowledge this is the first national study in Australia that has explored these aspects.

It is reported that all Australian tertiary institutes offering nursing have included education for students on computer use and health/nursing informatics (Smedley 2005). Our data support this observation as nurses with fewer years in nursing (and therefore more likely to be recent graduates of the tertiary education system) had pre-registration/pre-enrolment training in most applications. This finding also is consistent with previous research that showed proficiency in computer use increased by 50% in nurses with a tertiary education over those

entering the older hospital based training direct from secondary schools (Webster *et al*. 2003).

However, despite the obvious increase in ICT training, the survey figures suggest that education and training in ICT at an undergraduate level are still somewhat lacking. The formal training offered by at least some of the nursing schools is not to the degree that has been suggested (Smedley 2005). Although basic skills in the use of computers may be taught, perhaps the demand of the nursing curriculum do not allow for much more ICT training. Furthermore it would appear that this situation is not unique to Australia as recent surveys of US nursing schools and UK nurses generated similar conclusions (Nursix 2004, Maag 2006,).

Recent graduates are however still the minority in the nursing work force and the small number of nurses who had received PRPE education was not surprising given the relatively recent prevalence of computers and the number of nurses who had been nursing for long periods of time. The figures only emphasise the importance of continuous professional education (CPE) in ICT especially for the longer serving nurse. Unfortunately it would appear that over three quarters of the nurses had never received any formal training in ICT as part of their CPE.

The figure of fewer than a quarter of nurses attending formal computer training is considerably smaller than the figures of 54% and 61% reported in two studies of Brisbane hospitals (Edirippulige 2005, Webster *et al*. 2003). The much higher incidence in the Brisbane hospitals is attributed to the fact that they are tertiary urban hospitals with reported active encouragement of staff to undergo training.

It is reported that 55% of nurses in the UK in 2005 had completed basis computer skills (Bertulis & Lord 2005) whereas our figure is more in line with results obtained in Scotland a decade ago (Hillan *et al*. 1998). The results may reflect the focus that the NHS has had in recent years on such training. Indeed comparative studies of NHS nurses in the UK show that 30% of the nurses had received ICT training in the last six months and most of this was for half a day or more (Nursix 2004). This is in marked contrast to our results where only 3% had received any training in ICT the six months prior to the survey and only 12% in the last three years.

A good example of the need for CPE in ICT is in the rapidly expanding area of e-health. In a survey of hospital nurses in Queensland it was found that education and training was the main barrier to the adoption of e-health (Edirippulige 2005). Similar to the findings of our study, that study also found a high percent of respondents (88%) reported receiving no formal training specific to e-health. Without adequate education it is unrealistic to expect e-health to become integrated into health practice (Edirippulige 2005, Booth 2006). We concur with those sentiments but would not confine it solely to e-health and expand it to include the broad realm of ICT in nursing.

An important consideration to the need for CPE in ICT relates to the actual composition of the nursing workforce in Australia. In a representative study in Queensland breaks from nursing were reported by over 60% of nurses (Eley *et al*. 2005). One in five of the breaks were in excess of five years. It follows, therefore, that nurses who did not enjoy the benefits of ICT training previously will be among those continuously returning to the workforce. It is imperative that these nurses are able to access education and training relative to ICT if they are to be productive employees. Moreover in such a rapidly expanding area even if training had been received previously updating is essential.

In a paper on informatics competencies of nurses in Australia, Smedley (Smedley 2005) notes that knowledge and understanding of ICT is not required for AINs. However she stated that ENs require a basic level of ICT knowledge to function effectively. Furthermore the RN, who must be able to function in both clinical and administrative capacities, must have knowledge, understanding and skills. Our study findings reflect that these requirements mirror the proportion of nurses at different levels who have been trained. However, it is suggested that with severe workforce shortages, the lack of investment in the AIN may need to be reconsidered, particularly in the aged care industry, where these nurses comprise the largest proportion of the nursing workforce. Computers are no longer the exceptional item in any workplace and all levels of nurse require sufficient preparation in ICT to be effective employees in a changing industry. This is perhaps best reflected in the response from almost half of the nurses to this study who noted that further training in ICT was required for them to better meet the requirements of their job.

For the almost three quarters of nurses who had received training, the quality of training was considered to be good. The nurses also noted that the training that they had received was adequate to meet the needs of their current job and that it was given at an appropriate time. The preferred type and location of training was consistent with other reports (Chan *et al*. 2004, Edirippulige 2005) although in the latter survey 37% of nurses did indicate that web-based learning was a preferred choice. This is in contrast with our study in which fewer than 1 in 20 nurses selected distance learning as their preference.

It is encouraging that there fewer that so few nurses reported that training was actually discouraged by employers. However the data suggest that training in ICT takes a low profile among employers and encouragement by employers must be improved. A Royal College of Nursing study (RCN 2005) reported that those nurses with the best access to information were also more likely to both search for evidence and to change their nursing practice as a

result of research. The RCN report concluded that the encouragement of the employer was critical to these actions. That conclusion must be heeded if evidence based practice which is the desired approach to Australian health is going to be achieved.

In a recent survey of practice nurses in Australia, communication skills (which include ICT) were ranked as the highest of more than 50 clinical and non clinical skills requiring further education (Pascoe *et al*. 2007). The main barriers to that education were lack of time, cost of courses and travel and distance to education. The same barriers were noted in a study of Queensland nurses (Hegney *et al*. 2005) and again in this national study.

A quarter of respondents thought that their level of computer literacy was restricting their career development. In a profession where recruitment and retention continue to create headlines, it is imperative that Australian employers adopt policies to educate and train nursing staff. Strategies must be developed to ensure that funds exist so that relief staff are available to backfill. To facilitate access to training a major recommendation presented to government from this study promotes the provision of dedicated learning centres or education hubs in clinical areas.

Nurses want to learn. They want to use the technology to improve health care and they want to enhance their careers. Similarly to the UK (Nursix 2004) our respondents were overwhelmingly interested in training towards a national level of competency and lack of interest in computers was stated as not being a barrier to training. In Europe the Computer Driving Licence (EDCL) is becoming the recognised standard for nurses. Within the National Health Service (NHS) in the UK all nurses are entitled to take the ECDL free of charge and by 2004 11% of nurses had already completed the programme (Bertulis & Lord 2005). The NHS recognises that ICT skills are ‘essential’ (National Health Service 2007). The rational is simple; basic standard of ICT skills are an important step towards making full use of the new

systems. The ECDL analogy with driving is excellent. No-one in Australia is allowed to be in control of a motor vehicle without training and assessment of their ability. Why should nurses be expected to embrace technologies and applications such as evidence based practice without the same? The study clearly shows both the need for a national competency standard and the support by the nurses themselves for action.

These results endorse the Nursing Informatics' Australia recommendation that a national competency programme should be initiated (Conrick *et al*. 2004). Additional recommendations resulting from this study include supporting the development of a national ICT competency standard for nurses through the development of a national competency program in all PRPE education curricula.

CONCLUSION

This, the first comprehensive study of ICT training and education among nurse in Australia, has revealed gaps in knowledge and skills that may prevent optimum use of ICT in nursing. Strategies to overcome the gaps should be employed and must address the barriers to access of training. The willingness of nurses to increase their skills is a powerful ally to support strategies.

Contributions to the study

Study Design: RE, TF, JS, EB, DH
Data Collection and Analysis: RE, TF, EB, DH
Manuscript Preparation: RE, JS, DH

REFERENCES

Anderson S & Wittwer W (2004) Using bar-code point-of-care technology for patient safety. *Journal for Healthcare Quality* **26**, 5-11.

Australian Bureau of Statistics (2006) Australian Standard Geographical Classification (ASGC). Australian Bureau of Statistics, Canberra. Available at: http://144.53.252.30/AUSSTATS/abs@.nsf/productsbytitle/E28ED43CC3FC16DBCA25703E007FFFB3?OpenDocument (accessed 5 October 2007).

Bellis M (2007) *Bar Codes*. *Inventors.* About Inc., New York. Available at: http://inventors.about.com/library/inventors/blbar_code.htm (accessed 5 October 2007).

Bendigo Health (2006) *Quality of Care Report*. Bendigo Health, Victoria. Available at: http://www.bendigohealth.com.au/library/scripts/objectifyMedia.aspx?file=pdf/42/91.pdf&str_title=Quality_Care_Report2006.pdf (accessed 5 October 2007).

Bertulis R & Lord J (2005) *Where there's a way… there's a will! The Royal College of Nursing's information needs survey of nurses and health professionals*. Australian Library and Information Association, Canberra. Available at: http://conferences.alia.org.au/ebl2005/Bertulis.pdf (accessed 5 October 2007).

Booth RG (2006) Educating the future e-health professional nurse. *International Journal of Nursing Education Scholarship* **3**, 1-10.

Chan T, Brew S & de Lusignan S (2004) Community nursing needs more silver surfers: a questionnaire survey of primary care nurses' use of information technology. *BMC Nursing* **3** (4).

Conrick M, Hovenga E, Cook R, Laracuente T & Morgan T (2004) *A framework for nursing informatics in Australia - A strategic paper*: Nursing Informatics Australia. Available at: http://niaonline.org.au/html/Nursing%20Informatics%20in%20Australia_final%20Version1%5B1%5D.pdf (accessed on 5 October 2007).

Curran C (2003) Informatics competencies for nurse practitioners. *AACN Clinical Issues: Advanced Practice in Acute & Critical Care* **14**, 320 - 330.

Davenport C (2004) *Analysis of PDAs in Nursing: Benefits and Barriers*. PDA Cortex – online. Available at: http://www.rnpalm.com/Analysis_PDAs_Nursing.htm (accessed 5 Octover 2007).

Edirippulige S (2005) Australian nurses' perceptions of e-health. *Journal of Telemedicine and Telecare* **11,** 266-268.

Eley R, Hegney D, Buikstra P, Plank A & Parker V (2005) Tenure, mobility and retention in nursing in Queensland, Australia: 2001 and 2004. *Journal of Nursing Management* **15**, 285-293

Griffiths P & Riddington L (2001) Nurses' use of computer databases to identify evidence for practice - a cross sectional questionnaire survey in a UK hospital. *Health Information and Libraries Journal* **18**, 2-9.

Hegney D, Plank A, Buikstra E, Parker V & Eley R (2005) *Nurses worth listening to. A report to the Queensland Nurses' Union*. Toowoomba: University of Southern Queensland.

Hillan EM, McGuire MM & Cooper M (1998) Computers in midwifery practice: a view from the labour ward. *Journal of Advanced Nursing* **27**, 24 - 29.

Jackson C & Dewar J (2004). *Future of Health is Mobile.* Paper presented at the HINZ 2004.

Jiang WW, Chen W & Chen YC (2004) Important computer competencies for the nursing profession. *Journal of Nursing Research* **12**, 213 - 225.

Maag MM (2006) Nursing students' attitudes toward technology: A national study. *Nurse Educator* **31**, 112-118.

McCannon M & O'Neal P (2003) Results of a national survey indicating information technology skills needed by nurses at time of entry into the work force. *Journal of Nursing Education* **42,** 337-340.

National Health Information Advisory Council (2001) *Health Online - A Health Information Action Plan for Australia*: Australian Government, Canberra. Available at: http://www.health.gov.au/internet/wcms/publishing.nsf/Content/health-mediarel-yr2001-dept-mr01018.htm (accessed 5 October 2007).

National Health Service (2007) *Essential IT Skills (ECDL).* Government of Great Britain and Northern Ireland. Available at: http://www.ecdl.nhs.uk/ (accessed 5 October 2007).

Nursix (2004). *Nurses and NHS IT developments, Results of an online survey by Nursix.com on behalf of the Royal College of Nursing*. Royal College of Nursing, London, Available at: http://www.rcn.org.uk/publications/pdf/nurses_and_nhs_it_dev.pdf (accessed 5 October 2007).

Pascoe T, Hutchinson R, Foley E, Watts I, Whitecross L & Snowdon T (2007) The educational needs of nurses working in Australian general practice. *The Australian Journal of Advanced Nursing* **24**, 33-37.

Roughead E (1999) The nature and extent of drug-related hospitalisations in Australia, 1999. *Journal of Quality in Clinical Practice* **19**, 19-22.

Royal College of Nursing (2005) *Report of key findings of RCN's survey of the Information Needs of Nurses, Health Care Assistants, Midwives and Health Visitors*. Royal College of Nursing, Canberra. Available at: http://www.rcn.org.uk/downloads/news/INA%20report%20external.doc (accessed 5 October 2007).

Smedley A (2005) The Importance of Informatics Competencies in Nursing: An Australian Perspective. *CIN: Computers, Informatics, Nursing* **23**, 106-110.

Staggers N, Gassert C & Curran C (2002) A Delphi study to determine informatics competencies for nurses at four levels of practice. *Nursing Research* **51**, *383-390.*

Webster J, Davis J, Holt V, Stallan G, New K & Yegdich T (2003) Australian nurses and midwives knowledge of computers and their attitudes to using them in their practice. *Journal of Advanced Nursing* **41**, 140 -146.